EFFECT OF LUBRICATION CONDITION ON SURFACE ROUGHNESS BY USING LATHE MACHINE

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project report and in our opinion this project is satisfactory in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering with Manufacturing.

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STUDENT'S DECLARATION

"I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree"

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SPECIAL DEDICATED TO MY BELOVED FATHER MOHD BIN UMAR,

MOTHER ESAH BINTI ISMAIL, SIBLINGS

&

MY SUPERVISOR, MR LEE GIOK CHUI

FOR THEIR SUPPORT AND CARE…..

ACKNOWLEDGEMENT

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ABSTRACT

Cutting fluid is one of the important things in machining but it has many detrimental effects such as environmentally harmful and can cause skin and lung disease. Otherwise, cost of cutting fluid also had been issues lately because it frequently higher than cost of cutting tools and influence amount total machining cost. Because of that, dry machining and minimum quantity lubricant become alternatives to solve this problem. Objective of this project is identifying the effect of using minimum quantity lubricant compare with dry and wet machining on surface roughness. Three different materials are choosing as material test based on their hardness. There are ASTM B176 brass, AISI 1060 alloy and AISI 4340 steel. The experiment will performed under three different condition which are dry machining, minimum quantity lubricant and wet machining and will be conducted on lathe machine. After finished the experiment, it have find out that surface roughness grow slowly under minimum quantity lubricant continued by dry machining and wet machining. It means minimum quantity lubricant produced better surface finished compared with dry and wet machining. The result can significantly reduce cost and environmental pollution by using minimum quantity lubricant.

ABSTRAK

Cecair pemotongan adalah salah satu benda yang penting dalam pemesinan tetapi ia mempunyai banyak kesan yang merosakkan seperti membahayakan persekitaran dan akan menyebabkan kanser kulit dan paru-paru. Selain itu kos cecair pemotogan juga menjadi satu isu kebelakangan ini kerana kos cecair pemotongan kebiasaannye lebih tinggi daripada kos alat pemotong dan mempengaruhi kos keseluhan pemesinan. Oleh sebab itu, pemesinan secara kering, minimum kuantiti pelincir dan pemesinan secara basah menjadi alternatif untuk menyelesaikan masalah ini. Objektif projek ini adalah untuk mengenalpasti kesan penggunaan keadaan pelinciran yang berbeza terhadap tahap kekasaran permukaan. Tiga jenis bahan berlainan dipilih sebagai bahan ujikaji berdasarkan tahap kekerasannye. Ia terdiri daripada ASTM B176 brass, AISI 1060 alloy and AISI 4340 steel. Eksperimen ini dijalankan dengan tiga keadaan pelinciran iaitu pemesinan secara kering, minimum kuantiti pelincir dan pemesinan secara basah dengan menggunakan mesin larik. Selepas selesai menjalankan eksperimen, didapati kekasaran permukaan bertambah dengan perlahan menggunakan minimum kuantiti pelincir diikuti dengan pemesinan secara kering dan pemesinan secara basah. Ini bermaksud minimum kuantiti pelincir menghasilkan permukaan penyudah yg lebih baik dibandingkan dengan pemesinan secara kering dan basah. Keputusan itu bermakna kos dan pencemaran persekitaran dapat dikurangkan dengan menggunakan minimum kuantiti pelincir.

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LIST OF ABBREVIATIONS

Al	Aluminium
ASTM	American Society for Testing and Materials
GPa	Giga Pascal
MPa	Mega Pascal
SAE	Society of Automotive Engineers

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Cutting fluid or coolant is a liquid that important to reduce the friction coefficient between the grain and the workpiece by way of cooling and lubricating the cutting site of machine tools. The main purpose of using cutting fluid in machining process is to reduce cutting temperature and helps in carrying away the heat and debris produced during machining. It also can improve tool life and surface conditions.

Cutting fluids is one of important thing in machining but it has many detrimental effects. Many of the fluids, which are use in machining contain environmentally harmful or potentially damaging chemically constituents. These fluids are difficult to dispose and expensive to recycle. It also can cause skin and lung disease to the operator. For the companies, the amount of total machining cost influence by costs of cutting fluid. The cost relate to cutting fluids are frequently higher than those related to cutting tools. Consequently, elimination on the use of the cutting fluids if possible can be significant economic incentive. Because of that, alternatives has been sought to minimize using of cutting fluid in machining operations. Some of the alternatives are dry machining and minimum of lubricant [1][3].

Hence the implementation of machining without coolant (dry machining) will bring down the manufacturing cost but can cause tool wear problems and low surface

finish. Minimum quantity of lubricant also can cut cost and produce better surface finish than cutting dry.

The main objectives of this research experimentally investigated the role of minimum lubricant on surface roughness in turning Aluminum Alloy, brass and steel by using carbide insert and compare the effectiveness of minimum lubricant with difference condition which is dry and wet machining.

1.2 PROBLEM STATEMENT

1.2.1 Problem

The advantages of using cutting fluid have been questioned lately, due to several negative effects. Cutting fluid can cause skin and lung disease to the operator and air pollution to the nature. For the companies, cost of the cutting fluid influence the amount of total machining cost. It means these company enforce spend a lot of money for cutting fluid. Elimination of using cutting fluid or dry machining can be significant to economic incentive but can cause tool wear problems and low surface finish.

1.2.2 Solution of the problems

Some of the alternatives has been sought to minimize the using of cutting fluid without decrease surface quality. For these situations, semi dry or minimum quantity lubricant is a best way because beside will produce better surface finish, it also will bring down manufacturing cost and relieve pollution and risk of lung disease.

1.3 OBJECTIVE

The objectives of this study are to:

i. Identify the effect of using minimum quantity lubricant compare with dry and wet machining on surface roughness.
ii. Identify effectiveness of minimum quantity lubricant when time machining increase.

1.4 SCOPE OF THE PROJECT

i. Test different conditions of lubricant on different type of material.
ii. Test effect of different conditions of lubricant on surface roughness.
iii. Operating of lathe machine
iv. Using perthometer to test surface roughness

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is discussing on some literatures review related to effect of cutting fluid condition on surface roughness by using lathe machine.

2.2 CUTTING FLUID

Cutting fluid is a liquid added to reduce the friction coefficient between the grain and workpiece by way of cooling and lubricating [8] the cutting site of machine tools by flooding or spraying. The main purpose of using cutting fluid in machining process is to reduce cutting temperature [1][2][3][5]. The cutting fluid also can improve tool life [4] and surfaces conditions [1][2][3][5][6] beside in carrying away the heat and debris produced during machining [2]. The cutting fluid has many detrimental effects. Many of the fluids, which are use in machining contain environmentally harmful or potentially damaging chemically constituents. These fluids are difficult to dispose and expensive to recycle. It also can cause skin and lung disease to the operator. For the companies, the amount of total machining cost influence by costs of cutting fluid. The cost relate to cutting fluids are frequently higher than those related to cutting tools [1][2][3][5][6][9]. As reported by some authors, metal working fluids cost ranges from 7 to 17% of the total machining cost while the tool cost ranges from 2 to 4% [4]. The base of specially prepared cutting fluid is commercially available mineral oil. The cutting fluid contains

coolant, lubricant and additives such as surfactant, evaporator, emulsifier, stabilizer, biocide and deodorizing agent [7].

2.2.1 Soluble Cutting Oils

Water is an excellent cooling medium but has little lubricating value and hastens rust and corrosion. Therefore, mineral oils or lard oils which can be mixed with water are often used to form cutting oil. A soluble oil and water mix has lubricating qualities dependent upon the strength of the solution. Generally, soluble oil and water is used for rough cutting where quick dissipation of heat is most important. Borax and trisodium phosphate (TSP) are sometimes added to the solution to improve its corrosion resistance [13].

2.3 MACHINING CONDITIONS

Table 2.1: Recommended Lubrication Condition

MATERIAL	CUTTING OIL	
	Heavy Cutting	Light Cutting
Aluminum	-Dry -Soluble cutting oil	-Dry
Brass	-Dry -Soluble cutting oil	-Dry
Steel	-Soluble cutting oil	-Soluble cutting oil

2.3.1 Dry Machining

Dry machining is elimination on the use of cutting fluid. The interest in dry machining is often related to the low cost [2], healthy issues and environmentally friendly [1][3].Dry machining requires less power [8] .However, they are sometimes less effective [1][3]. This is because in dry machining higher order friction between tool and work and between tool and chip can lead to high temperature in the machining zone [2]. This high temperature at the machining zone will ultimately cause dimensional inaccuracies for the work piece and too wear problems [2] and also produce less surface finish.

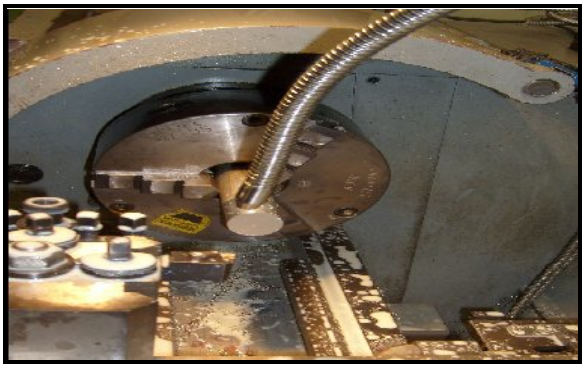

Figure2.1: Dry Machining

2.3.2 Minimum Quantity Lubricant

Minimum lubricant also known as semi-dry machining refers to the use of cutting fluids of only a minute amount-typically of a flow rate of 50-500ml/h. Which is about three to four orders of magnitude lower than the amount commonly use in flood cooling conditions [1][2][3][5]. Minimum quantity lubricant which can be regarded as replacement of dry machining [2] and also be considered as alternative to flood cooling [4][5]. The concepts of minimum quantity lubricant, sometimes referred to as near dry machining or micro lubrication [1][2][3][8]. Minimum quantity lubricant has been suggested a decade ago as a means of addressing the issues of environmental intrusiveness [5] and occupational hazards associated with the airbone cutting fluids particles on factory shop floors [1][3]. The minimization of cutting fluids also leads to economical benefits by way of saving lubricant cost, workpiece and tool [1][2][3]. Minimum lubricant with rapeseed oil has only a small lubricating effect in light loaded machining conditions. This was because the boundary film formed on the tool surface is not strong enough to sustain low friction and avoid adhesion of work material but minimum quantity lubricant with water droplets showed good lubrication performance during the same cutting conditions [1][2][3].

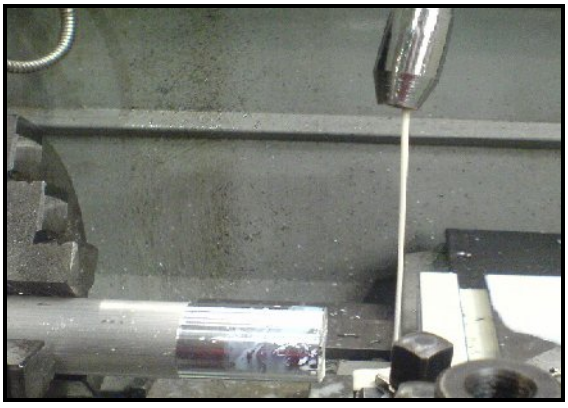

Figure 2.2: Minimum Quantity Lubricant

2.3.3 Wet Machining

In wet machining, both the tool and the workpiece are cooled using large quantities of lubricant. The coolant is subsequently cleansed and used again [1][3].

Figure 2.3: Wet Machining

2.4 LATHE MACHINE

The lathe is a one of the machine tools most well used by machining. It used principally for shaping pieces of metaland sometimes wood or other materials by causing the workpiece to be held and rotated by the lathe while a tool bit is advanced into the work causing the cutting action. The basic lathe that was designed to cut cylindrical metal stock has been developed further to produce screw threads, tapered work, drilled holes, knurled surfaces, and crankshafts. In order to get an efficient process and beautiful surface at the lathe machining, it is important to adjust a rotating speed, a cutting depth and sending speed.[6] Lathes must be lubricated and checked for adjustment before operation[15].

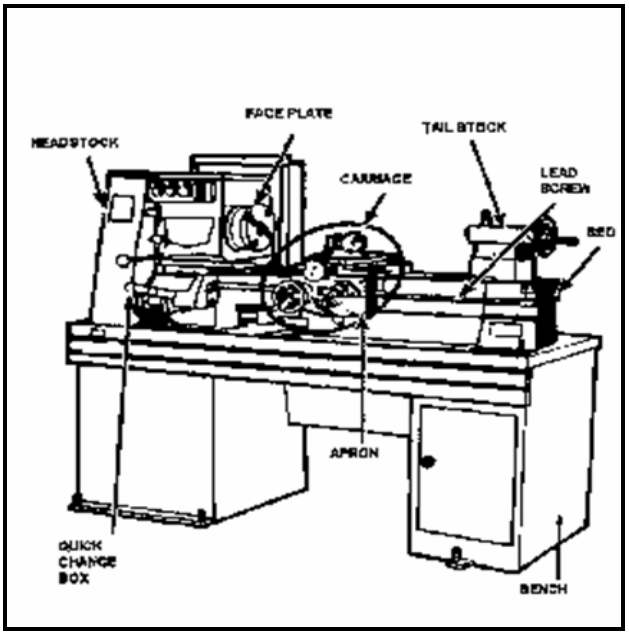

Figure 2.4: Lathe Machine

Source: America machine tools co. Instructions to Learn How to use a Lathe

2.4.1 Turning operation

Turning is another of the basic machining processes. Turning produces solids of revolution which can be tightly tolerance because of the specialized nature of the operation. Turning is performed on a machine called a lathe in which the tool is stationary and the part is rotated [15].

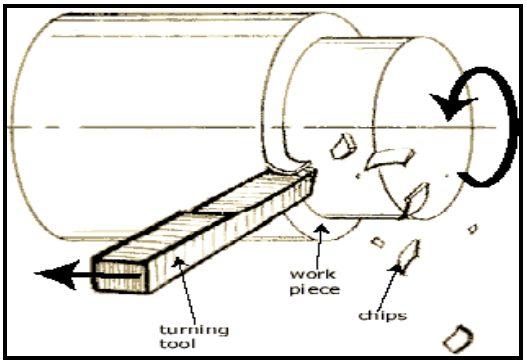

Figure 2.5: Cutting in Turning